

computers & graphics

**an international journal
of systems & applications
in computer graphics**

**algorithms and techniques for interaction,
multimedia, modelling and visualization**

**Editor-in-Chief
J. L. Encarnação
Fraunhofer-Institut für Graphische Datenverarbeitung**

**List of Contents and Author Index
Volume 22, 1998**

computers & graphics

Editor-in-Chief: **José L. Encarnação**
Fraunhofer-Institut für Graphische Datenverarbeitung,
Rundesturmstrasse 6, 64283 Darmstadt, Germany

Associate Editors: **Peter R. Bono**
President,
Peter R. Bono Associates, Inc.,
PO Box 648,
Gales Ferry, CT 06335
USA

Axel Hildebrand
ZGDV, Computer Graphics Centre,
Rundesturmstrasse 6,
D-64283 Darmstadt,
Germany

Associate Editor for
"Chaos & Graphics" Section: **Clifford A. Pickover**
IBM Thomas J. Watson Research Center,
Yorktown Heights, NY 10598, USA

Associate Editors for
"Education" Section: **Lars Kjell Dahl**
Numerical Analysis &
Computing Sciences, NADA,
Royal Institute of Technology KTH,
S-10044 Stockholm, Sweden

José Teixeira
Centro de Computação Gráfica,
R. Rodrigues de Gusmao, 21
3000 Coimbra, Portugal

Associate Editors for
"Algorithms Corner" Section: **Michael Gervautz**
Technische Universität Wien,
Institut für Computergraphic,
Karlsplatz 13/186/2,
1040 Wien, Austria

Markus Gross
Institut für Informationssysteme,
Department Informatik,
ETH-Zürich-Zentrum,
8092 Zürich, Switzerland

Editorial Advisory Board

Varol Akman Ankara, Turkey	Ilio Galligani Bologna, Italy	Myoung-Hee Kim Seoul, Korea	Philip K. Robertson North Ryde, Australia
Farhad Arbab Amsterdam, Netherlands	Robert K. L. Gay Singapore	Fumihiko Kimura Tokyo, Japan	David H. Salesin Seattle, WA, USA
Wilhelm Barth Wien, Austria	Bernd Girod Erlangen, Germany	Stanislav Klimenko Potvino, Russia	Seah Hock Soon Singapore
R. Daniel Bergeron Durham, NH, USA	Martin Göbel Sankt Augustin, Germany	Detlef Krömer Darmstadt, Germany	Jiaoying Shi Hangzhou, China
Ken Brodie Leeds, England	Donald P. Greenberg Itahaca, NY, USA	Marcio Lobo Netto São Paulo, Brazil	Václav Skala Pizen, Czech Republic
Pere Brunet Barcelona, Spain	Georges Grinstein Lowell, MA, USA	Carl Machover White Plains, NY, USA	Wolfgang Strasser Tübingen, Germany
Daniel Cohen-Or Tel-Aviv, Israel	Richard A. Guedj Evry Cédex/Les Epinettes, France	Sudhir P. Mudur Juhu, Bombay, India	Yasuhito Suenaga Nagoya, Japan
David Duce Chilton, Didcot, UK	Bartram Herzog Ann Arbor, MI, USA	D. H. Müller Dortmund, Germany	Tetsuo Tomiyama Tokyo, Japan
Bianca Falcidieno Genova, Italy	Frederic W. Jansen Delft, Netherlands	Eiachiro Nakamae Hiroshima, Japan	Bodo Urban Rostock, Germany
Dieter Fellner Bonn, Germany	Arie Kaufman Stony Brook, NY, USA	Robert D. Parslow Hampton, Middlesex, UK	Shin Ting Wu Campinas, Brazil
James D. Foley Atlanta, GA, USA		Bernard Peroche St. Etienne, Cédex, France	Michael J. Zyda Monterey, CA, USA

Author Service Department: For queries relating to the general submission of articles (including electronic text and artwork) and the status of accepted manuscripts, please contact the Author Service Department. *e-mail:* authors@elsevier.co.uk; *Fax:* +44 (0) 1865 843905; *Tel:* +44 (0) 1865 843900.

Publishing Office: Elsevier Science Ltd, Bampfylde Street, Exeter EX1 2AH, England [*Tel.* Exeter +44 (0) 1392 251558; *Fax* +44 (0) 1392 425370].

Annual Institutional Subscription Rates 1999: Europe, The CIS and Japan 2479.00 Dutch Guilders; all other countries US\$1258.00. Associated Personal Subscription rates are available on request for those whose institutions are library subscribers. Dutch Guilder prices exclude VAT. Non-VAT registered customers in the European Community will be charged the appropriate VAT in addition to the price listed. Prices include postage and insurance and are subject to change without notice.

PERIODICALS POSTAGE PAID AT RAHWAY, N.J. *Computers & Graphics* (ISSN 0097-8493) is published 6 issues per year in February, April, June, August, October and December, by Elsevier Science Ltd, The Boulevard, Langford Lane, Kidlington, Oxford OX5 1GB, UK. The annual subscription in the USA is \$1258. *Computers & Graphics* is distributed by Mercury Airfreight International Ltd, 365 Blair Road, Avenel, NJ 07001, USA. POSTMASTER: please send address changes to *Computers & Graphics*, c/o Elsevier Science Regional Sales Office, Customer Support Department, 655 Avenue of the Americas, New York, NY 10010, USA.



PERGAMON

Comput. & Graphics, Vol. 22, No. 6, pp. III-IX, 1998
© 1999 Elsevier Science Ltd. All rights reserved
Printed in Great Britain
0097-8493/99 \$ - see front matter

List of Contents

NUMBER 1

In this issue the special topic is **SCENE SIMPLIFICATION** *Guest Editor: Daniel Cohen-Or*

iii Computers & Graphics Best Paper Award

David Cohen-Or *Scene Simplification*

1 Guest Editor's Introduction

Chandrajit L. Bajaj and Daniel R. Schikore 3 Topology preserving data simplification with error bounds

Klein Reinhard 13 Multiresolution representations for surfaces meshes based on the vertex decimation method

Hugues Hoppe 27 Efficient implementation of progressive meshes

P. Cignoni, C. Montani and R. Scopigno 37 A comparison of mesh simplification algorithms

L. Darsa, B. Costa and A. Varshney 55 Walkthroughs of complex environments using image-based simplification

D. G. Aliaga and A. A. Lastra 71 Smooth transitions in texture-based simplification

S. L. Chan and E. O. Purisima *Technical Section* 83 A new tetrahedral tessellation scheme for isosurface generation

Shouqing Zhang, Ling Li and Hocksoon Seah 91 Vectorization of digital images using algebraic curves

D. Ghazanfarpour and J.-M. Hasenfratz 103 A beam tracing method with precise antialiasing for polyhedral scenes

J.-D. Liu, M.-T. Ko and R.-C. Chang 117 A simple self-collision avoidance for cloth animation

Mirek Majewski *Chaos & Graphics*

129 A tutorial on the realistic visualization of 3D Sierpinski fractals

J. C. Sprott 143 Artificial neural net attractors

I Past/Future Issues

III List of 1997 Reviewers

V Announcements

*In this issue the special topic is
WSCG'97*

Guest Editor: Václav Skala

WSCG'97	
Václav Skala	151 Guest Editor's Introduction
Charles A. Wüthrich	153 A model for curve rasterization in n -dimensional space
Mateu Sbert	161 Random walk radiosity with infinite path length
László Szirmay-Kalos and Gábor Márton	167 Analysis and construction of worst-case optimal ray shooting algorithms
Wolfgang Stürzlinger	175 Calculating global illumination for glossy surfaces
David Marcheix and Stefka Gueorguieva	181 Nibble meshing: incremental triangulation of non-manifold solid boundary
F. Jaijlet, B. Shariat and D. Vandorpe	189 Deformable object reconstruction with particle systems
Ioannis Korfiatis and Yakup Paker	195 Three-dimensional object metamorphosis through energy minimization
Martin Hartl, Ivan Křupka, Radek Poliščuk and Miroslav Liška	203 Computer-aided chromatic interferometry
Shin-Ting Wu, Sidney P. Campos and Marcus A. M. de Aguiar	209 Scientific visualization of Poincaré maps
<i>Technical Section</i>	
Paul Bao and Xiaolin Wu	217 L_∞ -constrained near-lossless image compression using weighted finite automata encoding
Chin-Chen Chang and Zen-Chung Shih	225 An accuracy enhancement algorithm for hierarchical radiosity
Jian J. Zhang	233 Least distorted bump mapping onto surface patches
Jin H. Jung and Hyun S. Yang	243 Window capturing-based application sharing under heterogeneous window systems
Chiew-Lan Tai, Yoshihisa Shinagawa and Tosiyasu L. Kunii	255 A Reeb graph-based representation for non-sequential construction of topologically complex shapes
Mahes Visvalingam and Kurt Dowson	269 Algorithms for sketching surfaces

Kamen Kanev and Tomoyuki Sugiyama	281	Design and simulation of interactive 3D computer games
Jose Angel Gonzalez Rodriguez	301	<i>Chaos & Graphics</i> A tutorial and recipe for moving fractal trees
Günter Kröber	307	Structure generation by palindromization
J. Encarnaçao, M. Mengel, P. Bono, K. Böhm, E. Borgmeier, J. Brisson-Lopes, C. Hornung, A. Knieriem-Jasnoch, E. Koch, D. Krömer, R. Lindner, C. Paris, A. Sandberg, M. Schnaider, D. Storck, J. Teixeira, B. Urban and T. Wang	319	<i>Education</i> A concept and system architecture for IT-based life-long learning

I Past/Future Issues

III Announcements

NUMBER 4

*In this issue the special topic is***DATA SECURITY IN IMAGE COMMUNICATIONS AND NETWORKING**
Guest Editor: Christoph Busch

Christoph Busch	397	<i>Data Security in Image Communications and Networking</i> Guest Editor's Introduction
Jian Zhao and Eckhard Koch	397	A generic digital watermarking model
G. Voyatzis and I. Pitas	405	Digital image watermarking using mixing systems
V. Darmstaedter, J.-F. Delaigle, J. J. Quisquater and B. Macq	417	Low cost spatial watermarking
Frank Hartung, Peter Eisert and Bernd Girod	425	Digital watermarking of MPEG-4 facial animation parameters
Lintian Qiao and Klara Nahrstedt	437	Comparison of MPEG encryption algorithms

Carlo Blundo and Alfredo De Santis	449 Visual cryptography schemes with perfect reconstruction of black pixels
Volker Roth and Mehrdad Jalali-Sohi	457 Access control and key management for mobile agents
Chengfu Yao and Jon G. Rokne	<i>Technical Section</i> 463 Run-length slice algorithms for the scan-conversion of ellipses
Qi Duan, K. Djidjeli, W. G. Price and E. H. Twizell	479 A rational cubic spline based on function values
Tahsin M. Kurç, Cevdet Aykanat and Bülent Özgür	487 Object-space parallel polygon rendering on hypercubes
Aadjan van der Helm, Peter Ebelt and Willem F. Bronsvoort	505 Modelling mollusc shells with generalized cylinders
Uwe Schneider	515 DaType: a stroke-based typeface design system
K. W. Chung, H. S. Y. Chan and B. N. Wang	<i>Chaos & Graphics</i> 527 'Smaller and smaller' from dynamics
Ning Chen and Weiyong Zhu	537 Bud-sequence conjecture on M fractal image and M-J conjecture between C and Z planes from $z \leftarrow z^w + c (w = \alpha + i\beta)$
Edward S. Briggs Jr and R. Daniel Bergeron	<i>Education</i> 547 A self-visualizing rendering support environment
Carlos Andújar	<i>Algorithms Corner</i> 557 Space efficient connectivity test for n -dimensional images
Yuefeng Zhang	559 Space-filling curve ordered dither
	I Past/Future Issues
	III Announcements
	NUMBER 5
P. Veron and J. C. Leon	<i>Technical Section</i> 565 Shape preserving polyhedral simplification with bounded error
Rafael J. Segura and Francisco R. Feito	587 An algorithm for determining intersection segment-polygon in 3D

Saurabh Sethia and S. Manohar	593 Minkowski operators for voxel based sculpting
Ignacio Martín, Frederic Pérez and Xavier Pueyo	601 The SIR rendering architecture
F. R. Feito and M. Rivero	611 Geometric modelling based on simplicial chains
A. Agathos, T. Theoharis and A. Boehm*	621 Efficient integer algorithms for the generation of conic sections
V. Drakopoulos	<i>Chaos & Graphics</i> 629 On the additional fixed points of Schröder iteration functions associated with a one-parameter family of cubic polynomials
Slawomir S. Nikiel	635 True-colour images and iterated function systems
Lin Feng and Seah Hock Soon	<i>Algorithms Corner</i> 641 An effective 3D seed fill algorithm
	I Past/Future Issues
	III Announcements

NUMBER 6

In this issue the special topic is
GRAPHICS IN/FOR DIGITAL LIBRARIES
Guest Editor: Dieter Fellner

D. W. Fellner, S. Havemann and G. Müller	647 <i>Graphics in/for Digital Libraries</i> Modeling of and navigation in complex 3D documents
Swen Campagna, Leif Kobbelt and Hans-Peter Seidel	655 Enhancing digital documents by including 3D-models
Andreas Schilling and Reinhard Klein	667 Rendering of multiresolution models with texture
O. Herzog, A. Miene, Th. Hermes and P. Alshuth	675 Integrated information mining for texts, images, and videos
Jonathan K. Su, Frank Hartung and Bernd Girod	687 Digital watermarking of text, image, and video documents
M. Friedrich, M. Melle and D. Saupe	697 ATLAS2000—Atlases of the future on the Internet

Wolf-D. Ihlenfeldt and Klaus Engel	703 Visualizing chemical data in the Internet—data-driven and interactive graphics
<i>Technical Section</i>	
Ming Wan, Steve Bryson and Arie Kaufman	715 Boundary cell-based acceleration for volume ray casting
O. S. Panykh, J. M. Tyler and W. N. Waggenspack Jr	723 Improved Monte Carlo form factor integration
Léo P. Magalhães, Alberto B. Raposo and Ivan L. M. Ricarte	735 Animation modeling with Petri Nets
Jarkko Oikarinen	745 Using 2- and $2\frac{1}{2}$ -dimensional seed filling in view lattice to accelerate volumetric rendering
<i>Chaos and Graphics</i>	
Asok K. Sen	759 A Product-Delay algorithm for graphic design
Nathan C. Carter, Stephen M. Grimes and Clifford A. Reiter	765 Frieze and wallpaper chaotic attractors with a polar spin
	781 Erratum
	783 Past/Future Issues
	785 Announcements

